

Newsletter of  
the Materials  
Physics and  
Applications  
Division



## Views of the Review

Bringing together technical staff from more than 25 groups in 10 divisions, the Materials Capability Review was held May 16-18 in the Study Center. The review, one of the first external capability-centric reviews to be held under the Laboratory's new management structure, was in support of the Laboratory's goal of being a capabilities-based national

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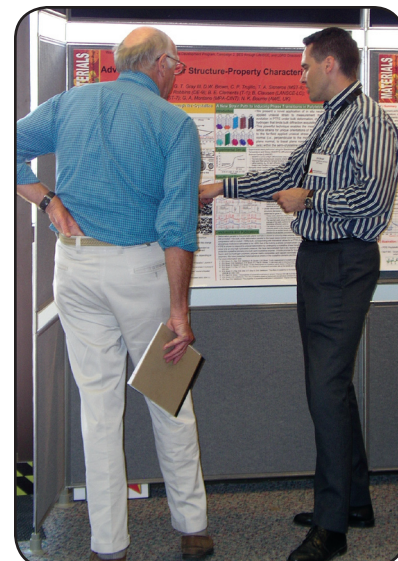
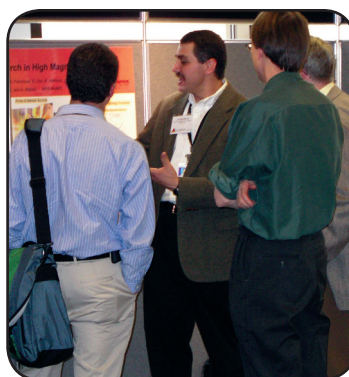
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Clockwise from top left: the materials dynamics poster session; MPA-10's Jackie Kiplinger discusses her work with Committee Member Ralph Nuzzo; MST Chief of Staff Jean Elson keeps presenters on time; MST-8's Eric Brown has a lively discussion about polymer science with Committee Member Phil Pincus; NHMFL's Chuck Mielke draws a crowd with his poster, including Committee Chair Tony Rollett and MST-16's Jeremy Mitchell; NHMFL's Vivien Zapf elicits a chuckle from the committee during her presentation; and

MST-8's Ellen Cerreta is joined at her poster by MPA-CINT's George Rodriguez.



## From John's desk

# Materials Physics and Applications: Happy Anniversary

Last week we successfully completed our first Materials Capability Review with a team of 10 external peers providing feedback on the quality and relevance of the Laboratory's integrated materials capability. I should begin with a note of thanks – to all of you who contributed technically to posters and talks, to Jean Elson and Karen Kippen, who did the heavy lifting on logistics, and to Paul Follansbee, John Wills, Marius Stan, and our own Alex Lacerda, who along with me each led one of the five thrusts on which we focused this year. The committee's report is due in two weeks; I look forward to sharing the results with you both in this venue and in future all-hands meetings—we are committed to hearing the committee's input and acting on their recommendations. We've also already begun planning of Materials Capability Review 2008, in which many parts of the Division that weren't emphasized this year will be highlighted. Overall, the feedback was positive and their judgment of the quality of the work that all of you do was uniformly high.

It is clear that the committee did struggle somewhat in understanding the full scope of the materials enterprise at Los Alamos and how it all connected to our broadly defined national security

mission. A big part of this was the rather different character of this review than past division reviews, which were more narrowly focused.

Nevertheless, it is important for all of us to both think through and be able to articulate why we do the work we do and what makes LANL the right place to do that work.

The timing of the Materials Capability Review was rather "convenient" in that it fell almost precisely on the one-year anniversary of the creation of MPA. While it's clear to me that we're still struggling with a few growing pains associated with a rather massive restructuring of the Laboratory, it's also even more evident that the breadth and depth of the technical contributions that all of you make has continued unabated. It is quite natural that the Laboratory will recount in various internal and external venues highlights from the past year, and I've heard that some form of all-employee celebration is also being planned for shortly after June 1. Rather than start this with my own "top 10" list, I'd like to turn the tables on all of you and encourage you to send me a few thoughts on the best and the worst of MPA's first year. I will report back what I hear from all of you.

I also know that a number of you are concerned about possible more negative consequences of the anniversary and how things might change going forward. In this context, I'd like to share with you a



direct quote from Mike Anastasio from the May 22 All-Manager's Meeting: "I have not asked DOE for approval for a Reduction In Force, and it is not in our plans to ask for one." While it is clear that the Laboratory remains under financial stress, we have made significant strides in closing funding gaps that exist – this again is due to the hard work, high productivity, and fiscal conservatism demonstrated by all of you. As we look towards FY2008, new challenges are bound to arise, but we'll continue to face them by remaining focused on executing our existing mission and growing new programs as efficiently and effectively as possible.

Finally, with the arrival of summer also comes the arrival of many summer students. Students are a remarkable asset to the Laboratory and MPA Division specifically. I encourage you to get to know the students that may be arriving in your groups and work to provide both technical and safety mentorship to them so that when summer ends they leave the Laboratory having had a rewarding and stimulating experience. One thing that MPA Division in partnership with the LANL institutes is doing to help in this regard is sponsoring a summer student lecture series. Details can be found at [http://int.lanl.gov/orgs/mpa/mpa10/student\\_liaison/lectures2007/](http://int.lanl.gov/orgs/mpa/mpa10/student_liaison/lectures2007/).

For those of you who are hosting students this summer, I strongly encourage you to have your students participate in this program (and perhaps even join them in attending some of the talks and tours). Learning about the broader activities and opportunities that exist at the Laboratory is an essential element of student education.

—MPA Division Leader John Sarrao

## Materials Physics and Applications

### material matters

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To read past issues of MPA Material Matters see [www.lanl.gov/orgs/mpa/materialmatters.shtml](http://www.lanl.gov/orgs/mpa/materialmatters.shtml)



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## "Review" Continued from page 1

security science laboratory.

Charged with evaluating the quality of science within the materials capability, a 10-member review committee from universities and national laboratories was presented with recent science and technological accomplishments from five theme areas representing a subset of the Laboratory's materials program—materials dynamics, actinide materials, multi-scale modeling, designed materials, and new characterization tools. (To read more about the review see John's *From the Desk*).



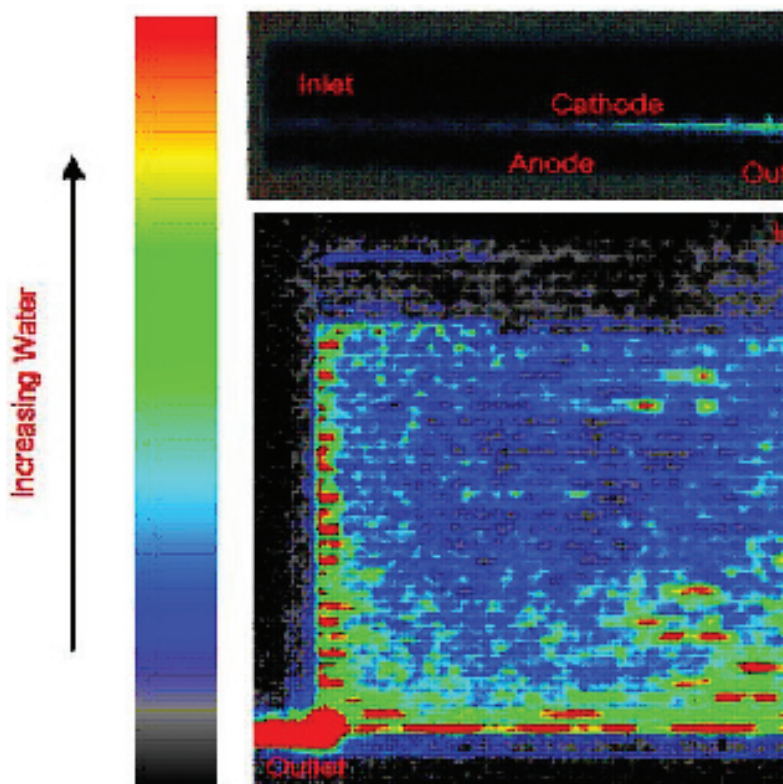
## MPA-11 neutron imaging of fuel cell water

Working around the clock with five days of beam time at the National Institute of Standards and Technology (NIST) Fuel Cell Neutron Imaging Facility MPA-11's Rangachary Mukundan, Tommy Rockward, John Davey and Jacob Spendelow obtained the first high-resolution images of the water distribution in an operating fuel cell in the "z" direction (through the membrane electrode assembly).

To reach this goal, the team used special Los Alamos-designed and fabricated single-cell test hardware. Data reduction will take several weeks, but preliminary results have already revealed liquid water accumulating in unanticipated locations.

Based on what was learned in these first experiments, Los Alamos National Laboratory expects improved images to be obtained in a follow-up experiment at NIST this month.

This work supports the four-year \$6.55M Fuel Cell Water Transport Exploratory Studies project awarded to LANL in the recent solicitation from the Office of Hydrogen, Fuel Cells and Infrastructure Technologies of the Department of Energy. This LANL-led project has formal collaborations with Case Western Reserve University, Oak Ridge National Laboratory, Sandia National Laboratory-Albuquerque, and two companies, W.L. Gore & Associates and SGL Technologies GmbH.



**The first high resolution (15-micron) image of the water distribution in an operating (2.25 cm<sup>2</sup> active area) fuel cell in the z-direction. (Bottom) The water distribution in a 50 cm<sup>2</sup> active area cell.**

## MPA-10 NMR team completes first <sup>235</sup>U NMR at Los Alamos

Direct uranium (U) nuclear magnetic resonance (NMR) is difficult because the relaxation times are usually too fast, rendering the NMR signal invisible in many compounds. The relaxation times are short because the coupling between the nuclear spins and the electron spins are very large in 4f and 5f systems.

If the electron spin dynamics can be sufficiently slowed down, the nuclear relaxation times can be long enough to allow detection. In the magnetically ordered

state of 4f and 5f compounds, the electron spins become static, and NMR of the nuclear spins is possible.

The NMR team successfully completed the first <sup>235</sup>U NMR at LANL. The team (Nicholas Curro and Seung Baek, both in MPA-10, with samples grown by Eric Bauer, MPA-10, Jason Cooley and James L. Smith, both in MST-6) has found the <sup>235</sup>U signal in an isotopically enriched sample of USb<sub>2</sub>.

In the antiferromagnetic state the

U spins experience a static hyperfine field of 277 T. These results were presented at the 2007 International Conference on Strongly Correlated Electron Systems in Houston this month.

The group plans to study the spectra and dynamics in a variety of other U based compounds, including the hidden order compound URu<sub>2</sub>Si<sub>2</sub>, and superconducting UPd<sub>2</sub>Al<sub>3</sub>, UPt<sub>3</sub>, and UBe<sub>13</sub>.

LDRD supported the research.

## MPA Division at MRS in San Francisco

Materials Physics and Applications Division actively participated in the Spring Materials Research Society Meeting in San Francisco.

STC's Leonardo Civale gave an invited talk on "How Much Further Can We Increase the Critical Currents in YBa<sub>2</sub>Cu<sub>3</sub>O<sub>7</sub> Films?"

In addition, MPA-STC delivered 13 presentations, including nine contributed talks. MPA-CINT delivered nine presenta-

tions, including talks on such topics as fabrication of fluorescent cellular probes, synthesis and photoluminescence of gold nanoclusters, and creation of fluorescent gold nanoclusters using rationally designed and combinatorially selected peptides. MPA-11 presented original research on characteristics of an organic light-emitting diode utilizing a phosphorescent, shallow hole trap, and organic materials for low cost, large area photoconductors.

# Heads UP, MPA!



## To push or to pull?

Pushing and pulling are two of the Laboratory's major source of injuries, resulting in 25 people hurt between June 2006 and February 2007.

Pushing a load is preferable for many reasons—to learn more and how to do both safely see the new safety short available at <http://int.lanl.gov/safety/>.

## Security awareness for students

Students are a vital part of the workforce at LANL and are part of the Laboratory's effort to reduce security incidents. As such they must follow security policies and procedures.

The security smart, found at <http://int.lanl.gov/security/documents/index.shtml#security-smarts>, is a useful refresher for returning students or primer for new arrivals. It offers information on badge use, escorting, information on the vehicle access portals, controlled and prohibited articles, portable electronic devices, and computer and operational security.

## Citizenship verification for uncleared US employees

To ensure current and future recipients of uncleared badges are only issued to US citizens, the Badge Office has implemented new procedures.

1. New LANL employees including subcontract workers who are submitted for a standard DOE or LANL-only uncleared badge must provide proof of citizenship at the time of badging. If a new employee does not provide proof of citizenship, he or she will not receive a badge.

2. Current LANL employees including subcontract workers who have been issued either a standard uncleared DOE or LANL-only badge intended for US citizens must establish their US citizenship no later than July 31, 2007. If an employee does not provide proof of citizenship by this time, his or her badge will be electronically deactivated, and further access to the Laboratory will be prohibited until the

Badge Office verifies proof of citizenship.

3. All current LANL employees and subcontract workers who are in process for a DOE security clearance and have already provided written proof of US citizenship to SEC-PSS6, Personnel Security Group, may be exempt from this process. These employees must contact the Badge Office prior to July 31 to ensure their badges will not be deactivated.

To learn more details see <http://int.lanl.gov/security/documents/index>.

## Wildlife encounters

Reports of Laboratory employees encountering wildlife have been in the news recently. In particular, an employee at LANSCE came within 10 or 15 feet of a mountain lion and her cub recently.

Fish and wildlife experts encourage any joggers, hikers, or other employees who work outside to be careful this time of year when many animals are raising their young and encounters could quickly escalate to a dangerous situation for Laboratory employees. Laboratory employees are lucky to work in such a mountainous setting, however, this setting is also habitat for mountain lions, black bears, elk, and deer. Any species of wildlife may become aggressive if they feel their young are threatened.

Mountain lions are quiet, solitary and elusive, and typically avoid people. Mountain lion attacks on humans are extremely rare. The following are some suggestions for outdoor activities especially during the wildlife nursery season: Do not hike, bike, or jog alone. Avoid hiking or jogging when mountain lions are most active—dawn, dusk, and at night. Keep a close watch on small children. Do not approach a mountain lion.

If you encounter a mountain lion, do not run; instead, face the animal, make noise and try to look bigger by waving your arms; throw rocks or other objects. If attacked, fight back.

## Sen. Bingaman and staff visit MPA-STC industrial partner Vital Alert

On April 2, Senator Jeff Bingaman and several members of his staff visited the offices of Vital Alert, an MPA-STC industrial partner located in the Los Alamos Research Park. The Senator and his staff learned more about the underground radio that is critical to enhancing mine safety and which is being developed in a partnership between Vital Alert and LANL.

## MPA-11 staff members host DC hydrogen sensor workshop

MPA-11 technical staff members Fernando Garzon and Cathy Padró, in cooperation with Bob Glass from Lawrence Livermore National Laboratory, hosted a hydrogen sensor workshop in Washington, D.C. on April 4 in support of the Department of Energy's Office of Hydrogen, Fuel Cells and Infrastructure Technologies (HFCIT, part of the Office of Energy Efficiency and Renewable Energy).

Attended by approximately 50 scientists and engineers from industry, national labs, and universities, the goal of the workshop was to develop technical targets for hydrogen safety sensors for the Safety, Codes & Standards Team of HFCIT. These targets will guide R&D investments and help measure progress, with potential applications ranging across all aspects of hydrogen production, distribution, storage, dispensing and use. A workshop report will be posted on the MPA-11 website. It is anticipated that a link to this page will be incorporated into the DOE Hydrogen Program website (as was a link to the workshop announcement).

## Got news?

*MPA Material Matters* features technical highlights developed each week for the Director's Office. If you have unclassified news you'd like to see featured, please send it to your group leader to be forwarded to *MPA Material Matters* Editor Karen Kippen.

*Heads UP, MPA! reports on environment, safety, and health, security, and facility-related news and information.*

## Students, make the most of your summer at Los Alamos. Get involved!

Summer students, there are a variety of opportunities to network and learn about the work being done at Los Alamos National Laboratory—besides hanging out at the local in-office espresso bar.

For starters—take in a tour of a laboratory and listen to a lecture by its resident expert.

MPA, in conjunction with the Los Alamos Institutes and Student Association, sponsors a summer lecture series specifically designed to allow new students, postdoctoral researchers, and staff to meet the best and brightest among Los Alamos scientists. During the month of June in 18 talks and site visits, participants will have a unique chance to see the facilities and learn about Los Alamos directly from our top scientists. Refreshments will be served.

To view the schedule, see [http://int.lanl.gov/orgs/mpa/mpa10/student\\_liaison/lectures2007/](http://int.lanl.gov/orgs/mpa/mpa10/student_liaison/lectures2007/).

Join your peers for an hour of lively discussion and debate at

MSCookies & Tea. Held Tuesdays at 4 p.m. in the Materials Science Laboratory's Meeting Place, the series features presentations by a diverse line up—from upper management offering their perspectives to your colleagues revealing their most recent research results. Recent standing-room-only events have featured MPA-10's Tomasz Durakiewicz discussing "The Benefits of Heresy" and MST-8's Mike Demkowicz on "Becoming a better scientist by learning the history of science." Open Projector events are back, after the smashing success in its first run. Anyone is welcome to bring a slide or two of the hottest results, bizarre experiments, or pictures from an epic weekend excursion to share and discuss with others. All this, and tea and cookies!

For more details, see <http://www.mst.lanl.gov/internal/calendar.shtml>.



## Who's new

Sheryl Bailey Heath is MPA's new human resources generalist. With a master's degree in international affairs, she brings 25 years of business and personnel management experience to the Division.

In her 18 months at Los Alamos, Heath, who is also the HR generalist for MST Division, has worked as an HR generalist in Physics, LANSCE, and X Divisions and the program offices for PADSTE.

She also participates in local organizations such as Los Alamos Aquatomics as well as Mountain School PTA and LA County Arts in Public Places Board. She has lived with her son in Los Alamos for five years.



**Sheryl Bailey Heath**

## Nastasi joins editorial board of *Materials Science and Engineering: R*; review article ideas requested

Michael Nastasi, MPA-CINT, has become an editorial board member of *Materials Science and Engineering: R*. The journal has one of the highest impact factors in materials science (10.0 in 2003, 14.2 in 2004, 10.5 in 2005) and has been ranked in the top three over the last few years, trading places with journals such as *Nature Materials* and *Nano Letters*.

As a board member, Nastasi is responsible for soliciting proposals for review articles, examining and voting on the proposed reviews brought in by the editorial board members, and overseeing the submission, review, revision and publication of his sponsored review articles.

Los Alamos scientists are encouraged to contact him with their ideas regarding potential review articles for the journal.

## Research on single-walled carbon nanotubes published in *Nature Materials*

Yuntian Zhu and Qingwen Li of MPA-STC, in collaboration with scientists at Peking University, have published in *Nature Materials* news of temperature-mediated growth of single-walled carbon-nanotube intramolecular junctions. The research shows that single walled carbon nanotubes (SWNT) have superior electronic and physical properties compared with conventional conductors. The work demonstrates SWNT are ideal candidates for the next generation of electronic circuits.

Single-walled carbon nanotubes (SWNTs) possess superior electronic and physical properties that make them ideal candidates for making next-generation electronic circuits that break the size

limitation of current silicon-based technology. The first critical step in making a full SWNT electronic circuit is to make SWNT intramolecular junctions in a controlled manner. Although SWNT intramolecular junctions have been grown by several methods, they only grew inadvertently in most cases.

In "Temperature-mediated growth of single-walled carbon-nanotube intramolecular junctions," the researchers report well-controlled temperature-mediated growth of intramolecular junctions in SWNTs. Specifically, by changing the temperature during growth," the researchers found that SWNTs systematically form intramolecular junctions. This was

achieved by a consistent variation in the SWNT diameter and chirality with changing growth temperature even though the catalyst particles remained the same. These findings provide a potential approach for growing SWNT intramolecular junctions at desired locations, sizes and orientations, which are important for making SWNT electronic circuits.

The work by Y. Yao, Q. Li, J. Zhang, R. Liu, L. Jiao, Y.T. Zhu, and Z. Liu appears in *Nature Materials* 6, 293 (2007) and was supported by Los Alamos National Laboratory's LDRD program, the National Science Foundation of China and Ministry of Science and Technology of China.